RXi2-BP

HARDWARE REFERENCE MANUAL

EMERSON

Contents

Section 1: Introduction 1

1.1 Document History 2
1.2 Capability and Compatibility 2
1.3 Software Requirements 2
1.4 Features 2

Section 2: Unpacking and Inspection 3

2.1 Package Contents 3
2.2 Available Options and Accessories 3
2.3 ESD and EMI 4
2.4 Unpack and Inspect 5
2.5 Handling 6

Section 3: Mounting 7

3.1 DIN Rail Mounting 7
3.2 Panel Mounting 9
3.3 Clearances requirements to all mounting options 10

Section 4: Installation and Startup 11

4.1 General Installation Guidelines 11
4.2 Required Materials 11
4.2.1 Power Supply 12
4.2.2 Keyboard 12
4.2.3 Video Monitor 12
4.3 Minimum System Requirements 12
4.4 Initial Startup 12
4.5 UEFI Firmware Setup 13
4.5.1 Entering UEFI Firmware Setup 13
4.5.2 Selective Alternative Boot Source 13
4.5.3 Setting up Boot Priority 13
4.5.4 Restoring UEFI Settings 13
4.5.5 Configuring Hibernation and Sleep States 13
4.5.6 UEFI Passwords 13
4.5.7 Secure Boot Configuration 13

Section 5: Installation and Replacement Procedures 14

5.1 Remove and Attach Cover 14
5.2 Replace the Real-Time Clock (RTC) battery 15
5.3 Inserting and removal of µSD Card 17
5.4 Change M.2 Mass Storage Device 18

Section 6: Hardware Interfaces 20

6.1 External Interfaces 20
6.1.1 Power-In 20
6.1.2 LEDs 21
6.1.3 Buttons 21
6.1.4 Ethernet Ports 22
6.1.5 USB2 / USB3.2Gen1 23
6.1.6 DisplayPort 24
6.1.7 Serial Ports 25
6.1.8 µSD Slot 26
6.2 Internal Interfaces 26
6.2.1 M.2 (SATA) 26
6.3 Internal Devices 26
6.3.1 MRAM 26
6.3.2 Temperature Sensor 27

Section 7: Hardware and Firmware Programmable Devices ... 28

7.1 SMBUS Devices 28
7.2 I2C Devices 28
7.3 Ethernet 28
7.4 PCIe Switch 28
7.5 Multi I/O 28
7.6 PCIe Ports 29
7.7 PCI Routing 29

Section 8: Thermal Performance 31

8.1 x86 Processor Thermal Design Features 31
8.1.1 Dynamic CPU Frequency and Boost Modes 31
8.1.2 CPU Throttling 31
8.1.3 Temperature Monitoring and Protection 32
8.2 Thermal Design Strategy 33
8.2.1 Thermal Guidance 33
8.2.2 Thermal Test Data 34

Section 9: Specifications 36
9.1 Power Consumption 36
9.2 Temperature 37
9.3 Shock and Vibration 37
9.4 Altitude 38
9.5 Regulations and Certifications 38
9.6 Battery 38
9.7 Technical Specifications 38
Section 10: Troubleshooting 39
10.1 Unexpected Restarts When Booting 39
10.2 Booting Problems, Hardware Devices Not Present 39
General Contact Information 40
Technical Support 40

Warnings and Caution Notes as Used in this Publication

⚠ WARNING

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury, exist in this equipment, or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

⚠ CAUTION

Caution notices are used where equipment might be damaged if care is not taken.

NOTICE

Notes and information that are not safety-related.

Note: Notes merely call attention to information that is especially significant to understanding and operating the equipment.

These instructions do not purport to cover all details or variations in the equipment, nor to provide for every possible contingency to be met during installation, operation, and maintenance. The information is supplied for informational purposes only, and Emerson makes no warranty as to the accuracy of the information included herein. Changes, modifications, and/or improvements to equipment and specifications are made periodically and these changes may or may not be reflected herein. It is understood that Emerson may make changes, modifications, or improvements to the equipment referenced herein or to the document itself at any time. This document is intended for use by trained personnel familiar with the Emerson products referenced herein.

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Section 1: Introduction

A Computer-On-Module (COM) is a module containing all the components necessary for a bootable host computer, packaged as a super component. A COM requires a carrier board to connect I/O and power up. COMs are used to build modular solutions and to offer Original Equipment Manufacturer (OEMs) fast time-to-market with reduced development cost. Like integrated circuits, they provide OEMs with significant freedom in meeting form-fit-function requirements. For these reasons, the COM methodology has gained much popularity with OEMs in the embedded industry.

The RXi2-BP IPC industrial computing platform delivers compact, rugged, mid to high-performance computing and high-performance graphics capabilities to run HMI, historian, and analytics applications for real-time control of operations.

The RXi2-BP IPC (R2B Series) is composed of the following components:

- mC10L19 COM Express module based on AMD Ryzen V1000 or R1000 series
- CEC10 COM Express type 10 carrier board
- Industrial grade enclosure with heat sink for the module and carrier components

This chapter describes the features, capabilities, and compatibilities of the RXi2-BP IPC and its components.

Figure 1: RXi2-BP IPC

1.1 Document History

Rev	Date	Description
B	November 2020	• Updates to product label • Updates to Regulations and Certifications
A	Oct 2020	Initial revision

1.2 Capability and Compatibility

The mC10L19 COM Express module is a fully x86 compatible single board computer module, containing many functions in a very small form-factor. It is based on the PICMG COM Express Module Base Specification V3.0 Type 10. (Refer to the documentation located at www.picmg.org.) The mC10L19 uses the AMD family 17h models 10h-1fh (V1000 and R1000) Ryzen Core Processor.

The CEC10 COM Express carrier board is also compliant with the PICMG COM Express Module Base Specification R3.0 Type 10 (refer to the documentation located at http://www.picmg.org).

The RXi2-BP power supply module provides a voltage input of nominal 24 V DC (± 25%) and supports under and overvoltage supervisory, and protection against reverse polarity.

1.3 Software Requirements

- Microsoft® Windows® 10 Professional 64-Bit IoT 2019 LTSC
- Linux® Kernel 5.4

1.4 Features

RXi2-BP IPC module features are as follows:

- AMD Ryzen V1000
  - 4c/8t V1000, TDP 12 - 25W, L2 2MB, L3 4MB, 8 GPU CU, Industrial-temp, 4 to 16GB DDR4-2400 ECC RAM (single rank)
- AMD Ryzen R1000
  - 2c/4t R1000, TDP 8 - 10W, L2 1MB, L3 2MB, 3 GPU CU, 4 to 16GB DDR4-2400 ECC RAM (single rank)
- 1x Display Port V1.4
- 2x USB 2.0
- 2x USB3.2 Gen1
- 4x Gig Ethernet ports (1 Realtek RTL8111 controller and 3 Intel i210IT controllers, supporting TimeSYNC IEEE1588 and 802.1AS)
- Mini PCIe slot (half size) as option
  - Unified Infrastructure Management (UIM) interface
- M.2 PCIe M-Key and SATA Gen3 capability
- fTPM V2.0
- Two serial interfaces (1x RS-232, 1x galvanic isolated RS-485/RS-422)
- Operating at 24 V dc (±25%), including over- and under-voltage protection
- Reverse polarity protection

Section 2: Unpacking and Inspection

This chapter describes unpacking, initial inspection, and required preparation considerations before using the RXi2-BP IPC. Perform the procedures in this chapter to verify proper operation after shipping and before system integration.

⚠ CAUTION

If the RXi2-BP IPC operates in the high ambient temperature up to 70°C (149 ° F), the surface of the enclosure, especially the heat sink, can reach a temperature of 85°C (185 °F) and above. Be careful and do not touch the RXi2-BP IPC with bare fingers.

Si le RXi2-BP IPC est opérée à une température ambiante élevée jusqu'à 70 ° C (149 ° F), la surface du boîtier, en particulier le dissipateur thermique, peut atteindre une température de 85 ° C (185 ° F) et plus. Soyez prudent et ne touchez pas le RXi2-BP IPC avec les doigts nus.

2.1 Package Contents

Verify that the delivered package contains the contents listed in the following table.

Table 2-1 Delivery Volume

Item	QTY	Description
RXi2-BP	1	RXi2-BP Industrial PC
Serial Connector Plug	2	Serial Connector Plug
24 V Power-In Connector Plug	1	Power Connector Plug
Quick Start Guide	1	Quick Start Guide (GFK-3196)

2.2 Available Options and Accessories

The following tables list the available accessories for the RXi2-BP IPC. For the complete list of orderable product SKUs please refer to the RXi2-BP Datasheet

Table 2-2 Available Accessories

Item	Description
R2B00ACCMP01	1pcs Mounting Panel Kit R2B
R2B00ACCRM01	1pcs DIN Rail Mounting Kit R2B

Note: For the most current information on options and accessories, contact the nearest Emerson sales or service office, or an authorized Emerson sales representative. Options are subject to change without notice.

2.3 ESD and EMI

Electrostatic Discharge (ESD) is the discharge of static electricity. Electromagnetic Interference (EMI) is a disturbance generated by an external source that affects an electrical circuit by electromagnetic induction, electrostatic coupling, or conduction. ESD and EMI issues may come up when installing and connecting the system to the other components. There are many ways to avoid problems with these issues.

Any operational system with cables for I/O signals, connectivity, or peripheral devices provide an entry point for ESD and EMI. If Emerson has not manufactured the complete system, including the enclosure and cables, then it is the responsibility of the system integrator and end-user to protect their system against potential problems. Filtering, optical isolation, ESD gaskets, and other measures might be required at the physical point of entry (enclosure).

Products manufactured by Emerson should normally be suitable for use in properly designed and produced customer equipment (cabinets, racks) without any major redesign. However, the systems might be subject to ESD and EMI problems once installed and interconnected with other systems. The end-user, system integrator, or installer must test for possible problems and in some cases, show compliance to local regulations as required in his country or by the intended application.

⚠ CAUTION

Static-sensitive Devices: Handle only at static-safe work stations.

⚠ CAUTION

This is an FCC Class A product intended for use in an industrial environment. In a home or residential environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

⚠ CAUTION

Drain static electricity before you install or remove any parts. Installing or removing modules without observing this precaution could result in damage to this and/or other modules or components in your system.

Wear a properly-functioning anti-static strap and make sure you are fully grounded. Any surface upon which you place the unprotected module or unit should be static-safe, which is usually facilitated by the use of anti-static mats. From the time it is removed from the anti-static bag until it is in the board carrier and functioning properly, extreme care should be taken to avoid zapping the component with ESD. Be aware that you could zap the component without knowing it; a small discharge, imperceptible to the eye and touch, can often be enough to damage electronic components. Extra caution should be taken in cold and dry weather when electrostatics easily builds up.

Only after ensuring that both you and the surrounding area are protected from ESD, carefully remove the component from the shipping carton by grasping the module on its edges. Place the component, in its anti-static bag, flat down on a suitable surface. You may then remove the component from the anti-static bag by tearing the ESD warning labels.

2.4 Unpack and Inspect

⚠ WARNING

Before installing or removing any board or module, ensure that the system power and external supplies have been turned off.

⚠ WARNING

DO NOT apply power to the board if it has visible damage. Doing so may cause further, possibly irreparable damage, as well as introduce a fire or shock hazard.

NOTICE

Retain all packing material in case of future need.

Before unpacking the board or module, or fitting the device into your system, read the manual carefully. Also, adhere to the following guidelines:

- Observe all precautions for electrostatic sensitive modules.
- If the product contains batteries, do not place it on conductive surfaces, anti-static plastic, or a sponge, which can cause shocks and lead to battery or board trace damage.
- Do not exceed the specified operational temperatures. Batteries and storage devices might also have temperature restrictions.
- Keep all original packaging material for future storage or warranty shipments of the board.

After unpacking the component, inspect it for visible damage that may have occurred during shipping or unpacking. Although the product is carefully packaged to protect it against the rigors of shipping, it is still possible that shipping damages may occur. A careful inspection of the shipping carton should reveal some information about how the package was handled by the shipping service.

If evidence of damage or rough handling is found (usually in the form of bent component leads or loose socketed components), notify the shipping service as soon as possible and contact Emerson for additional instructions. Depending on the severity of the damage, it may be necessary to return the product to the factory for repair.

2.5 Handling

⚠ WARNING

If the RXi2-BP IPC operates in high ambient temperature up to 70°C (149 ° F), the surface of the enclosure, especially the heat sink, can reach a temperature of 85°C (185 °F) and above. Be careful and do not touch the RXi2-BP IPC with bare fingers.

Si le RXi2-BP IPC est opérée à une température ambiante élevée jusqu'à 70 ° C (149 ° F), la surface du boîtier, en particulier le dissipateur thermique, peut atteindre une température de 85 ° C (185 ° F) et plus. Soyez prudent et ne touchez pas le RXi2-BP IPC avec les doigts nus.

⚠ CAUTION

Install the RXi2-BP IPC only in areas with restricted access.

Equipment for use in locations where children are not likely to be present.
Pour l'équipement destiné à être utilisé dans des endroits où les enfants ne sont probablement pas présents.

Section 3: Mounting

RXi2-BP IPC cooling is designed for wall mounted orientation of the box. There are two possible mounting options:

- Din Rail Mounting
- Mounting Panel

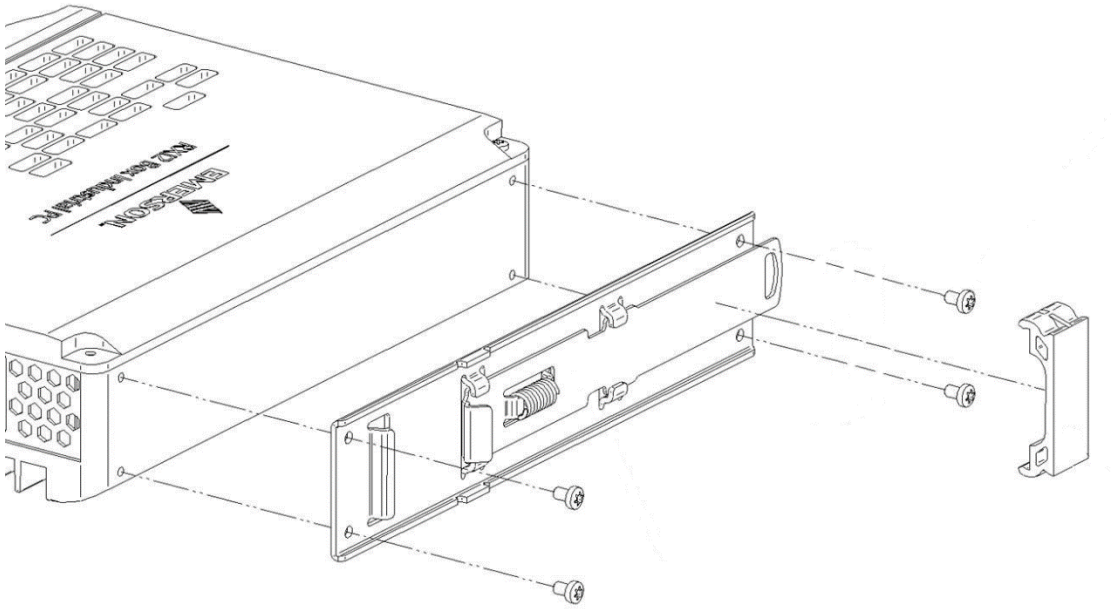
3.1 DIN Rail Mounting

To mount the IPC to a DIN rail, the user will need to connect DIN Rail Clamp #R2B00ACCRM01 to the rear of the IPC:

1. Place the DIN Rail on the rear face of the RXI2-BP IPC.
2. Using a T9 Torx driver, secure the DIN rail with the provided M3x5-A2 screws, tightening to 0.6 Nm. (Do not overtighten.)

Note: For rugged applications, use a thread-locker to ensure that screws do not loosen.

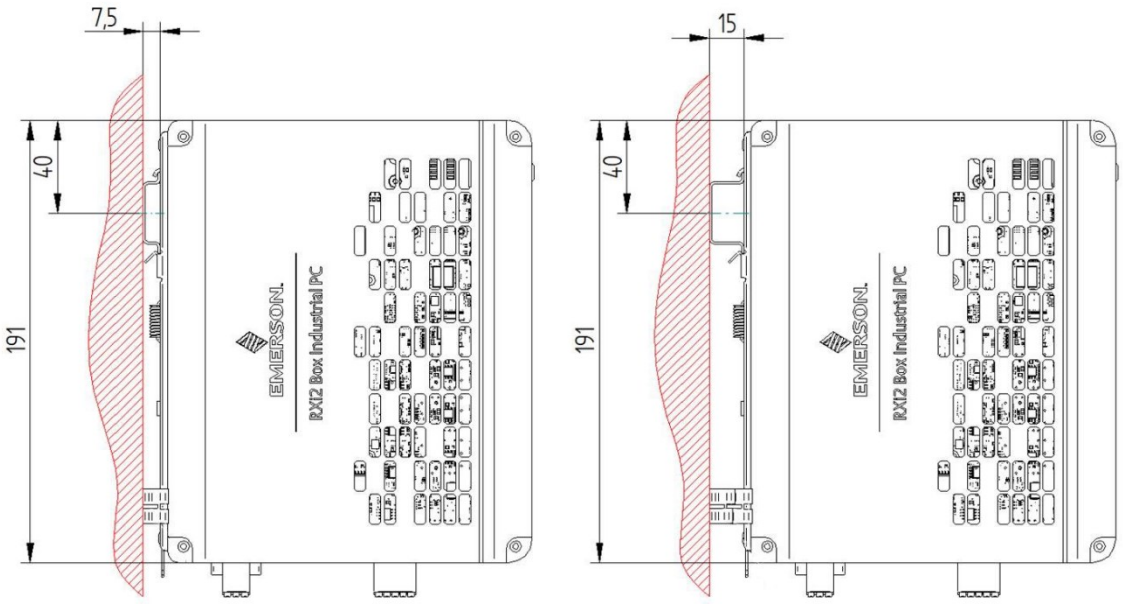
Figure 2: Attaching a DIN Rail to an RXI2-BP IPC



There are two DIN rail mounting options available, depending on the size of the DIN rail connector.

- If the DIN connector is 7.5 mm in height: use a single DIN rail support to offset the bottom of the IPC.
- If the DIN connector is 15 mm in height: use two DIN rail supports in a stack to increase the height to offset the bottom of the IPC.

Figure 3: RXi2-BP IPC DIN Rail Mounting Options



3.2 Panel Mounting

To mount the IPC in a panel mount configuration, the user will need to connect Mounting Panel #R2B00ACCMP01 to the rear of the IPC:

1. Place the mounting plate on the rear of the IPC.
2. Using a T9 Torx driver, secure the mounting plate with the two provided M3x6 screws, tightening to 0.6 Nm. (Do not overtighten.)
3. For regular mounting, secure the mounting plate and IPC through the top and bottom center holes. For more rugged applications, secure the mounting plate with the four provided M3x6 screws in all four corners of the mounting panel.

Figure 4: Attaching Mounting Plate RXi2-BP IPC

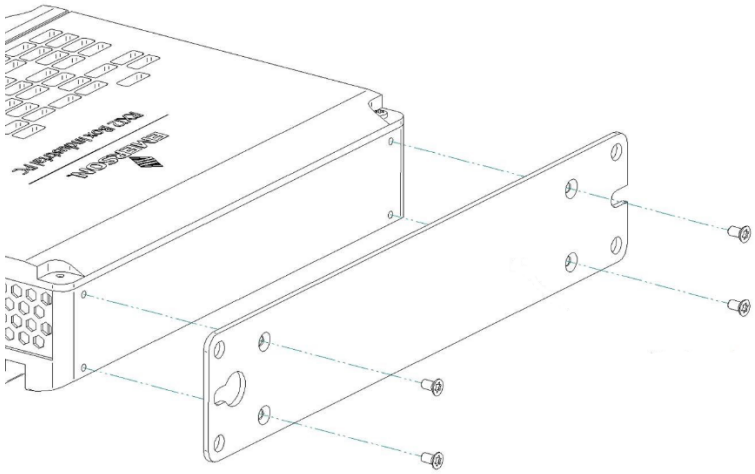
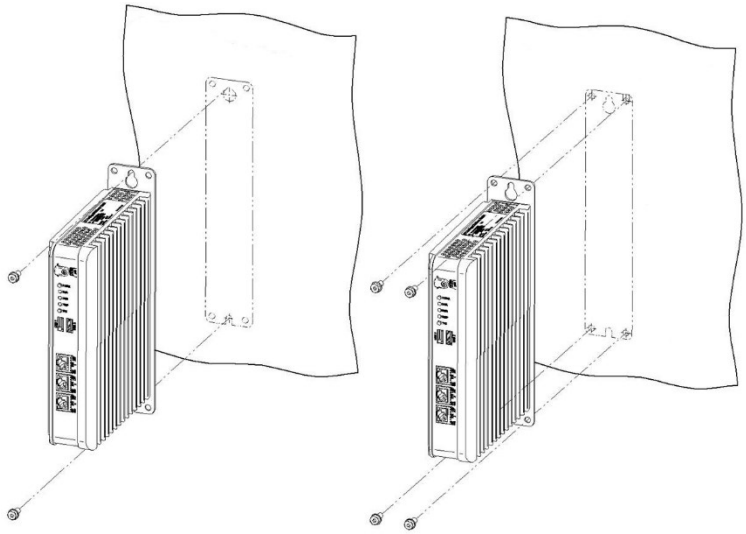


Figure 5: RXi2-BP IPC DIN Rail pre-mounting

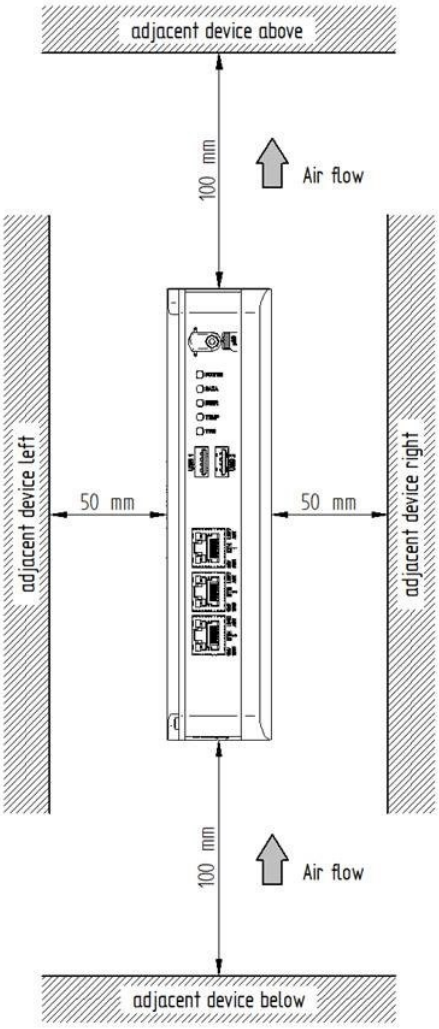


3.3 Clearances requirements to all mounting options

Figure 6 shows the optimal clearances requested by RXi2-BP to operate within full thermal specifications and is applicable for DIN rail and panel mount option.

Any deviation in requested clearance will result in reduced thermal performance and must be evaluated by the customer based on the final setup.

Figure 6: Minimum Clearances



Section 4: Installation and Startup

This chapter describes the installation and initial startup operations.

⚠ WARNING

Before installing or removing any component, make sure that the system power and external supplies have been turned off.

⚠ CAUTION

Static-sensitive Devices: Handle only at static-safe work stations.

⚠ CAUTION

Drain static electricity before you install or remove any parts. Installing or removing modules without observing this precaution could result in damage to this and/or other components in your system.

4.1 General Installation Guidelines

Adhere to the following guidelines during installation:

- Observe all safety procedures to avoid damaging the system, and to protect operators and users.
- Before installing or removing any board, verify that the system power and external supplies have been turned off.
- Make sure the RXi2-BP IPC is properly mounted.
- Connect all I/O cables.
- Do not restore power until all components are fitted correctly into the system and all connections have been made properly.

4.2 Required Materials

The following items are required to start the RXi2-BP IPC in a standard configuration:

- Power supply
- Keyboard and mouse
- Video monitor

4.2.1 Power Supply

⚠ WARNING

Verify that the power supply is turned off while installing boards or modules into the RXi2-BP IPC.

Adhere to the following guidelines:

- Verify that the power supply can meet the total power requirements of the RXi2-BP IPC. (Refer to the section Specifications.)
- Verify that the power supply is not turned ON while opening the enclosure to install add-on boards and modules into the RXi2-BP IPC (such as the PCIe boards or internal SATA drives).

4.2.2 Keyboard

A compatible USB keyboard for the initial system operation of the RXi2-BP IPC is required. Depending on your application, this may be a standard keyboard or one that uses membrane switches for harsh environments.

4.2.3 Video Monitor

Any video monitor with a native Display Port (or a suitable adaptor for the Display Port) can be used for the initial setup.

4.3 Minimum System Requirements

The RXi2-BP IPC has been thoroughly tested and is nearly ready for usage in the target system. To verify operation for the first time, Emerson recommends that you only configure a minimal system. It is not necessary to have disk drives, a flash disk, or other accessories connected, to perform the Power-On Self-Test (POST).

4.4 Initial Startup

A few seconds after powering up, the RXi2-BP IPC system UEFI Firmware banner will display on the screen. If you do not see any error messages up to this point, the RXi2-BP IPC is running properly and ready to be configured for your application.

Note: *If the RXi2-BP IPC does not perform as described above, some damage may have occurred during shipment, or the board is not installed or configured properly. Contact Emerson for technical support. (Refer to the section Contact Information.)*

4.5 UEFI Firmware Setup

4.5.1 Entering UEFI Firmware Setup

To enter setup during the initial startup sequence: press the **Delete** or **F2** key during the startup sequence.

Adhere to the applicable on-screen messages when prompted.

To save changes, go to Save & Exit page and choose **Save Changes and Exit** option

4.5.2 Selective Alternative Boot Source

To select an alternative boot device (for example, boot from USB stick), without changing settings in UEFI Firmware, please press and hold the **F7** key during the power-up sequence

4.5.3 Setting up Boot Priority

To configure a particular boot priority, within UEFI Firmware Setup, navigate to the Boot page and configure **Boot Option #1** and **Boot Option #2**, as required. Go to Save & Exit page and choose **Save Changes and Exit** option.

4.5.4 Restoring UEFI Settings

When within UEFI Firmware Setup, navigate to the Save & Exit page, choose **Restore Defaults**, choose **Save Changes and Exit**.

4.5.5 Configuring Hibernation and Sleep States

When within UEFI Firmware Setup, navigate to the Advanced page, choose ACPI Settings, make required changes. Go to Save & Exit page and choose **Save Changes and Exit** option.

4.5.6 UEFI Passwords

To configure Administrator and User passwords, within UEFI Firmware Setup, navigate to Advanced page, choose **Security**, make required changes. Go to Save & Exit page and choose **Save Changes and Exit** option

4.5.7 Secure Boot Configuration

To configure Secure Boot, change/reset Keys, within UEFI Firmware Setup, navigate to the Advanced page, choose the **Secure Boot** option, make required changes. Go to Save & Exit page and choose **Save Changes and Exit** option

Note: For in-depth technical information about the CPU and its peripherals, please refer to the mC10L19 Hardware Reference Manual (GFK-3096).

Section 5: Installation and Replacement Procedures

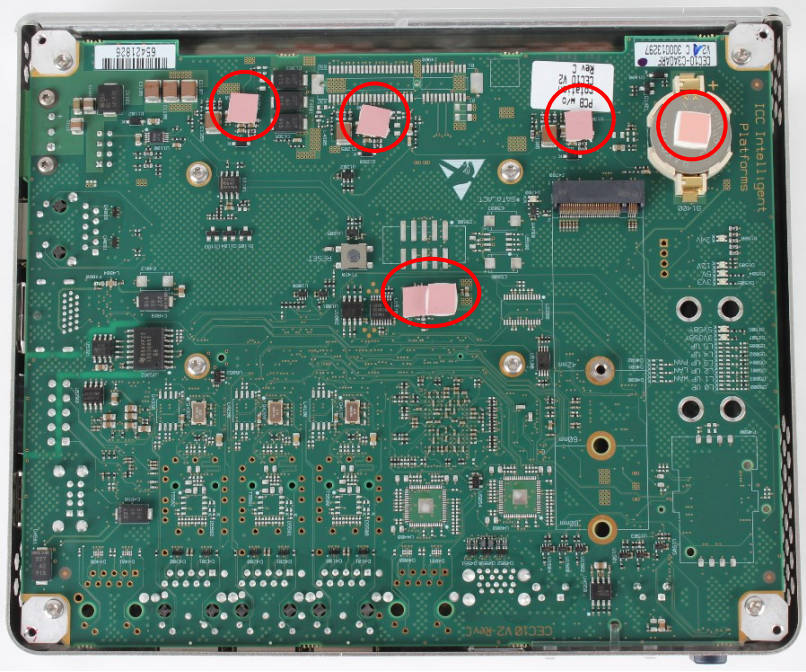
5.1 Remove and Attach Cover

1. Shut down the system and remove power from the RXi2-BP IPC.
2. Loosen the four screws on the RXi2-BP IPC's top cover and remove it (Figure 7).

Figure 7: IPC Cover

3. Please be aware that all six gap pads are in position (Figure 8). They are a part of thermal management, and important for the system's lifetime. The battery has a thicker gap pad. **Do not mix!**

Figure 8: Position of Six Gap Pads



4. Once the desired maintenance or replacement task is completed, attach the cover again, double-check that the lid is correctly placed. Tighten the four screws with 0.6 Nm.

5.2 Replace the Real-Time Clock (RTC) battery

⚠ WARNING

There is a danger of explosion if the battery is incorrectly replaced. Replace only with the same or equivalent to Rayovac BR2032 or CR2032. Dispose of used batteries according to Emerson provided instructions and applicable local regulations.
Battery can only be exchanged by skilled person.

⚠ CAUTION

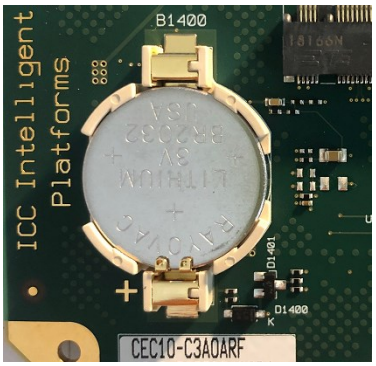
Static-sensitive Devices: Handle only at static-safe work stations.

NOTICE

The information described in this section applies to service technicians only.

1. Follow instructions on how to remove the cover, see Section 5.1, *Remove and Attach Cover.*
2. Locate the RTC battery (Figure 9).

Figure 9: RTC Battery



Note: The gap pad is already removed.

3. Remove the RTC battery carefully from the retaining clip.
4. Install a new RTC battery in the retaining clip with the positive (+) side up and reapply the gap pad. (The gap pad establishes a thermal connection from battery to the lid. Otherwise, thermal derating might be required).

⚠ WARNING

The battery may explode if mistreated. Do not recharge, disassemble, heat above 100° C (212 °F), or incinerate!

⚠ WARNING

When replacing, use only Rayovac BR2032 or equivalent battery. Using other batteries may result in fire or explosion!

5. To attach cover, follow instructions in Section 5.1, *Remove and Attach Cover.*

5.3 Inserting and removal of µSD Card

1. Unscrew µSD card lid with Tx 8 screwdriver until µSD opening is accessible.
2. Inserting µSD card into the opening (Figure 10).

Figure 10: Inserted µSD card before plugging in

3. Plug-in µSD card until you hear a click. The populated connector is a push-push connector (Figure 11).

Figure 11: Plugged in µSD card

4. Re-attach the lid and tighten the screw to 0.45 Nm (Figure 12).

Figure 12: Close µSD card lid

5. To remove the µSD card, remove the lid first and push it carefully in the same direction as step 3, the µSD card will pop out slightly and can then be removed.

5.4 Change M.2 Mass Storage Device

NOTICE

The information described in this section applies to service technicians only.

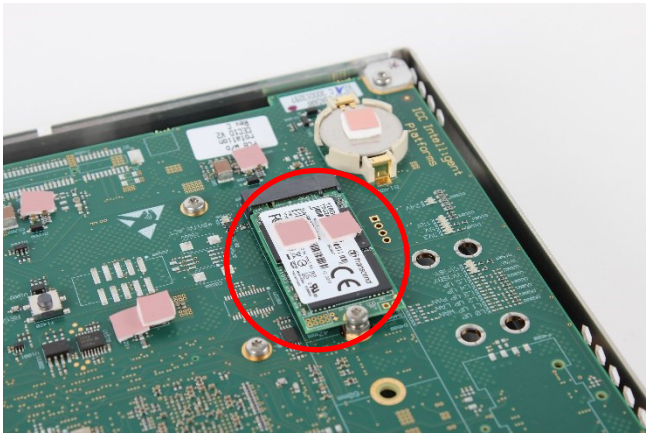
The M.2 mass storage devices are by standard a 2242 form factor and can be replaced with the same form factor without any changes. If other form factors are required, please contact Emerson support for instructions on how to move the mounting nut.

⚠ WARNING

Verify that the power supply is turned off while installing boards or modules into the RXi2-BP IPC.

1. To remove the cover, follow instructions in Section 5.1 *Remove and Attach Cover.*
2. Locate M.2 mass storage and unscrew the Tx 8 screw (Figure 13).

Figure 13: Populated M.2 Mass Storage



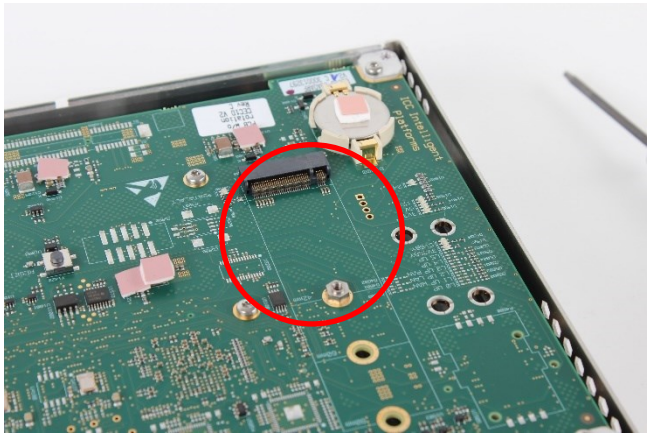
Note: Red gap pads on the M.2 storage must be re-used.

3. Remove the M.2 mass storage device (Figure 14).
4. Remove the thermal gap pads from the M.2 mass storage device and store them for reuse on a replacement device

Figure 14: Screw Removal

4. An empty slot is now ready for new M.2 mass storage devices (Figure 15).

Figure 15: Empty Slot

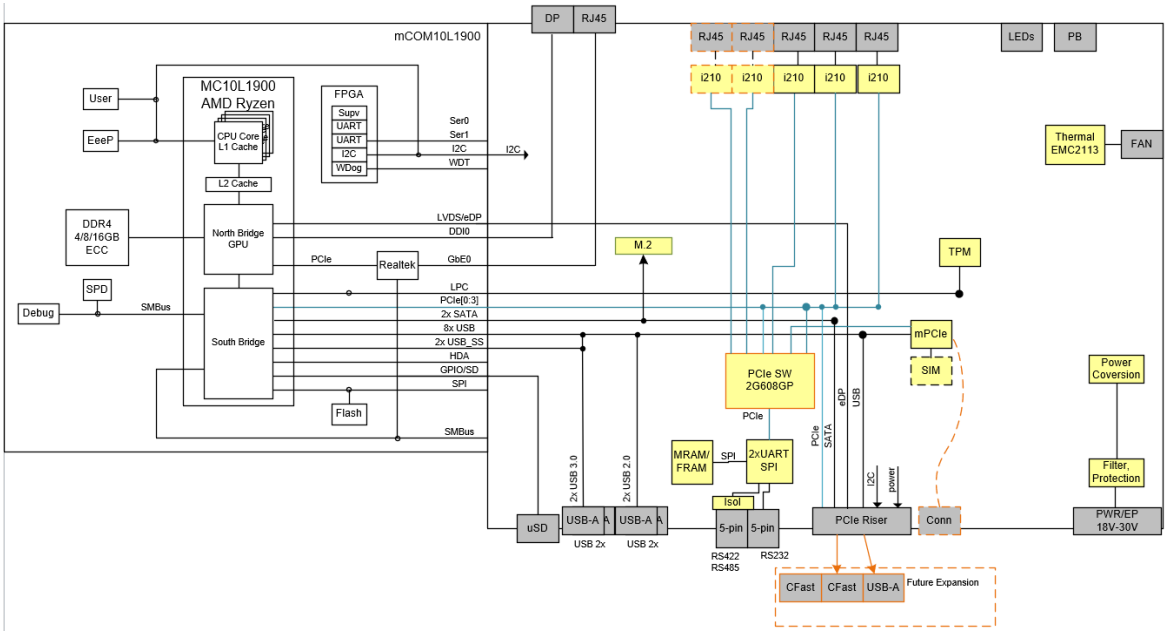


5. To insert a new M.2 storage device, connect the M.2 storage device in the slot and tighten the mounting screw to 0.45 Nm
6. Reuse the gap pads from the previous M.2 module. Install them in the same location as shown in Figure 13. (The gap pad establishes a thermal connection from M.2 to the lid, otherwise, thermal derating may be possible).
7. Follow instructions in section 5.1, *Remove and Attach Cover*.

Section 6: Hardware Interfaces

This chapter describes the hardware interfaces used in the RXi2-BP.
The following diagram provides an overview of the way the hardware interface is used.

Figure 16: Overview of the Interface Usage



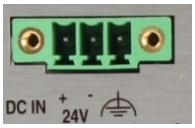
Note: Dotted lines show optional features (for details please contact the factory).

6.1 External Interfaces

6.1.1 Power-In

The corresponding plug must be a Phoenix Contact "1748367" or equivalent.
RXi2-BP can be powered with a DC power supply with 24V (+-25%) and at least delivering 1.8 A.

Figure 17: 24V DC-IN

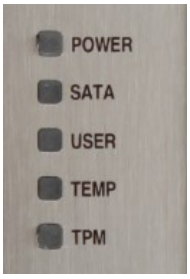


Signal Name	Pin (left to right)
Power + (24V DC)	1
Power - (24V DC)	2
FGND	3

6.1.2 LEDs

The RXi2-BP provides a set of different status-LEDs on the front panel to indicate various functions.

Figure 18: LEDs



LED Name	Color	LED status indication
Power (also a button)	Green	All power rails available and valid (S0)
	Yellow	Standby power valid (S3/S4/S5)
	Red	Error condition, contact Emerson support for help.
SATA	Green	SATA access in progress (M.2)
USER	Green	Reserved for future use
TEMP	Green	Temperatures below T_{hot} and T_{crit}
	Yellow	Temperatures above T_{hot} and below T_{crit} If supported by OS, a graceful shutdown is initiated
	Red	Temperatures above T_{hot} and T_{crit} An immediate shutdown has occurred to protect the system
TPM (also a button)	Yellow	If physical presence is activated, this LED shows the current status of the pysical presence state.

6.1.3 Buttons

The RXi2-BP provides two buttons - one Power button and one TPM button.

6.1.3.1 Power Button

Pressing (short push) the power button triggers the operating system to shut down (Power State S5). If the operating system does not immediately shut down, press and hold the Power button for more than 5 sec to force the RXi2-BP IPC to shut down immediately without operating system support.

State S5 (Soft-off mode) will switch off the CPU core power and reset the RXi2-BP IPC. The state S5 is indicated with a yellow power LED. At this stage, it is possible to reactivate the RXi2-BP IPC by pressing (short push) the Power button. This action will switch on the CPU core voltage, and the board will restart.

6.1.3.2 TPM Button

If active, the TPM button is needed to enter UEFI Firmware Setup and to boot sources (via F7).
If disabled, the button has no functionality.

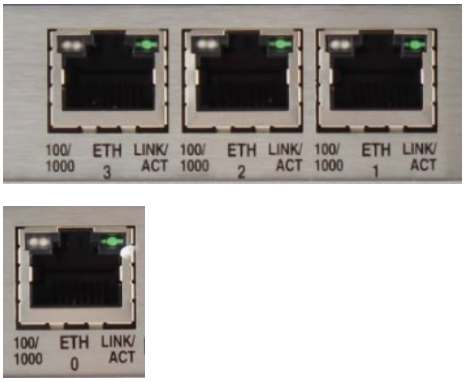
6.1.4 Ethernet Ports

The RXi2-BP provides four Ethernet ports: three RJ45 ports at the front, and one at the bottom. All Ethernet ports support 10/100/1000 Base-T. For a proper 100/1000 Mbit connection, a CAT5 cable is recommended.

The three RJ45 ports located at the front (ETH1-3) are connected to Intel I210 devices located on the carrier.

The one RJ45 port located at the bottom (ETH0) is connected to the on-module Realtek RTL8111EP Ethernet Controller.

Figure 19: Ethernet Ports

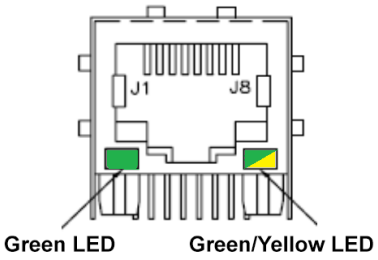


10/100 BaseT Name	1000 BaseT Name	Pin
TxD+	LP_DA+	1
TxD-	LP_DA-	2
RxD+	LP_DB+	3
NC	LP_DC+	4
NC	LP_DC-	5
RxD-	LP_DB-	6
NC	LP_DD+	7
NC	LP_DD-	8

6.1.4.1 Ethernet Ports LEDs

Same configuration for all Ethernet ports:

Figure 20: Ethernet Ports LEDs



Pin	LED color	LED status indication
12	Green	ACT/LINK Blink with activity, Steady on with no activity at 10/100/1000
13/14	Green Yellow Off	LINK1000 (steady on) LINK100 (steady on) LINK10

6.1.5 USB2 / USB3.2Gen1

The RXi2-BP provides two USB2 (USB 3 & 4) and two USB3.2 Gen1 (USB 1 & 2) ports. All four are USB type-A connectors.

Each port (USB2 and USB3.2 Gen1) is protected with an electrical fuse rated up to 1 A.
For normal operation, please do not exceed 900mA for USB3.2 Gen1 and 500mA for USB2.

6.1.5.1 USB2

Figure 21: USB2 Port and Pinout

Signal Name	Pin
VCC (5V_SBY)	1
USB-	2
USB+	3
GND	4

6.1.5.2 USB3.2 Gen1

Figure 22: USB3.2 Gen1 Port and Pinout

Signal Name	Pin
VCC (5V_SBY)	1
USB-	2
USB+	3
GND	4
SSRX-	5
SSRX+	6
GND	7
SSTX-	8
SSTX+	9

6.1.6 DisplayPort

RXi2-BP provides one Display port (DP1) interface that provides signals for connecting either a suitable DP-monitor or an adaptor to several other display standards.

Figure 23: DisplayPort Pinout

Signal Name Pin	Pin
TxD0+/-	1/3
TxD1+/-	4/6
TxD2+/-	7/9
TxD3+/-	10/12
AUXSEL	13
NC	14
CLK/AUX+	15
DAT/AUX-	17
HTPLG	18
DP_VCC	20
GND	2, 5, 8, 11, 16, 19

6.1.7 Serial Ports

The RXi2-BP provides two serial interfaces, one configured to RS232 (P0) and one configurable to RS422 or RS485 [2W/4W] (P1). The connector is a Phoenix contact "1953745" or equivalent and mates with Phoenix contact "1952296." Two mating plugs are shipped with the system.

Figure 24: Serial Ports

Signal Name Pin RS232	Pin
TX	1
RTS	2
GND	3
CTS	4
RX	5
Signal Name Pin RS4xx	**Pin**
RX+	6
RX-	7
GND	8
TX-	9
TX+	10

For RS–422 and RS–485-4-wire modes, connect the corresponding RX+/- signals with the TX+/- signals and vice versa on the remote device.
For RS–485 2-wire mode connect RX+ and TX+ with the + line of the cable and the RX- and the TX- together with the – line of the cable.

The difference between the various RS–4xx modes is the TX/RX signal control. In the RS-422 mode, TX and RX are always active. In RS-485 4-wire mode, TX is only active when there is something to transmit, RX is always active. In RS-485 2-wire mode, TX and RX are active when transmitting and inactive when not transmitting. The various modes can be selected via the Operating System device driver.

The RXi2-BP system does not provide any termination resistors. If required, the termination can be attached to the plug directly.

6.1.8 µSD Slot

The RXi2-BP provides a µSD card slot with a mechanical lock.

Figure 25: µSD Slot

Signal Name	Pin
DATA2	1
DATA3	2
CMD	3
VDD	4
CLK	5
VSS	6
DATA0	7
DATA1	8
CD	9

6.2 Internal Interfaces

6.2.1 M.2 (SATA)

A mass storage M.2 type M-connector (per Spec 3.0 V1.2; June 2019) is located under the system lid and can only accommodate devices with the SATA interface; no NVMe modules are supported.
Form factors 2042, 2060, and 2080 are supported and 2042 is the default.
If you require to change from form factor 2042 to any other please contact Emerson support for guidance.

The pinout is specified in the M.2 standard and is not listed in this document.

6.3 Internal Devices

6.3.1 MRAM

The RXi2-BP is capable of Non-Volatile Random Access Memory (MRAM) with 1 Mbit.

MRAM is an optional feature. Contact Emerson for assistance.

6.3.2 Temperature Sensor

UEFI Firmware sets up two thermal zones on the RXi2-BP carrier board that can be observed with an EMC2113 device. This device contains internal temperature sensors. Three external temperature sensors are also connected.
All external sensors are grouped as one thermal group and placed so that the hottest point can be observed, no matter the mounting style.
The EMC2113 device measures the temperature of several higher-rated devices (GBE; Multi I/O; PCIe Switch) with the help of a common heatsink.
Please also refer to Section 6.1.2 *LEDs* for additional information.

Section 7: Hardware and Firmware Programmable Devices

7.1 SMBUS Devices

Device	Address [7b format]	Function
PI6CDBL402B	6Eh	Clock Buffer 4x
TCA9554	20h	SMB Port Expander
EMC2213	2Eh	Temperatur Controller
PI7C9X2G608GP	68h	PCIe Switch

7.2 I2C Devices

Device	Address [7b format]	Function
24C64	57h	Carrier EEPROM
TCA9554	20h	I2C Port Expander

7.3 Ethernet

The Ethernet controllers provide an iNVM, which contains the MAC address, as well as their configuration. This content is not accessible to the user.

7.4 PCIe Switch

The PCIe switch has a dedicated EEPROM connected for configuration and is not accessible to the user.

7.5 Multi I/O

The Multi I/O controller (in this system, configured to 2x serial and 1x SPI bridge) has a dedicated EEPROM connected for configuration and is not accessible to the user.

7.6 PCIe Ports

Source	Port	Destination
COMe PCIe	0	Diodes PI7C9X2G608GP (PCIe Switch Upstream port)
COMe PCIe	1	Intel I210 #1 (GBE)
COMe PCIe	2	Intel I210 #2 (GBE)
COMe PCIe	3	RiserSlot
PI7C9X2G608GP PCIe	1	Intel I210 #3 (GBE)
PI7C9X2G608GP PCIe	4	Intel I210 #4 (GBE) (not populated in 4 GBE version)
PI7C9X2G608GP PCIe	5	AX99100 (Multi I/O)
PI7C9X2G608GP PCIe	6	Intel I210 #5 (GBE) (not populated in 4 GBE version)
PI7C9X2G608GP PCIe	7	mPCIe slot

Note: Ports 2 & 3 are not useable in used PI7C9X2G608GP configuration.

7.7 PCI Routing

Function	Connected to	Vendor ID/System ID	Device	Bus:Dev:Func
mC10L19				
Host Bridge		AMD / 1022	15D0	0:0.0
IOMMU		AMD / 1022	15D1	0:0.2
Host bridge		AMD / 1022	1452	0:1.0
PCI Bridge	1:0.0	AMD / 1022	15D3	0:1.1
PCI Bridge	2:0.0	AMD / 1022	15D3	0:1.2
PCI Bridge	3:0.0	AMD / 1022	15D3	0:1.4
PCI Bridge	A:0.0	AMD / 1022	15D3	0:1.5
Host bridge		AMD / 1022	1452	0:8.0
PCI Bridge	B:0.0	AMD / 1022	15DB	0:8.1
PCI Bridge	C:0.0	AMD / 1022	15DC	0:8.2
SMBus		AMD / 1022	790B	0:14.0
ISA Bridge		AMD / 1022	790E	0:14.3
Host bridge		AMD / 1022	15E8	0:18.0
Host bridge		AMD / 1022	15E9	0:18.1
Host bridge		AMD / 1022	5EA	0:18.2
Host bridge		AMD / 1022	15EB	0:18.3
Host bridge		AMD / 1022	15EC	0:18.4
Host bridge		AMD / 1022	15ED	0:18.5
Host bridge		AMD / 1022	15EE	0:18.6
Host bridge		AMD / 1022	15EF	0:18.7
GBE (on-module)		Realtek / 10EC	8168	1:0.0
GBE (on-module) serial		Realtek / 10EC	816A	1:0.1
GBE (on-module) serial Note: Not user useable		Realtek / 10EC	816B	1:0.2
GBE (on-module) IPMI Note: Not user useable		Realtek / 10EC	816C	1:0.3
GBE (on-module) USB		Realtek / 10EC	816D	1:0.4
VGA compatible Controller		AMD / 1022	15DD	B:0.0
Audio Device		AMD / 1022	15DE	B:0.1

Function	Connected to	Vendor ID/System ID	Device	Bus:Dev:Func
mC10L19				
Encryption controller		AMD / 1022	15DF	B:0.2
USB controller		AMD / 1022	15E0	B:0.3
USB controller		AMD / 1022	15E1	B:0.4
Multimedia controller		AMD / 1022	15E2	B:0.5
Audio device		AMD / 1022	15E3	B:0.6
Non-VGA unclassified device		AMD / 1022	15E6	B:0.7
SATA Controller		AMD / 1022	7901	C:0.0
CEC10				
GBE		Intel / 8086	157B	2:0.0
PCI Bridge upstream		Diodes / 12D8	2608	3:0:0
PCI Bridge downstream		Diodes / 12D8	2608	4:1:0
PCI Bridge downstream	6:0.0	Diodes / 12D8	2608	4:2:0
PCI Bridge downstream	7:0.0	Diodes / 12D8	2608	4:3:0
PCI Bridge downstream		Diodes / 12D8	2608	4:4:0
PCI Bridge downstream		Diodes / 12D8	2608	4:5:0
Serial Controller		ASIX / 125B	9100	6:0.0
Serial Controller		ASIX / 125B	9100	6:0.1
Memory Interface		ASIX / 125B	9100	6:0.3
GBE		Intel / 8086	157B	7:0.0
GBE		Intel / 8086	157B	A:0.0

Note: This routing is only an example of one particular system and bus numbers >0 are likely to change.

Section 8: Thermal Performance

Thermal design with modern x86 processor architecture is a complex topic with many variables that contribute to the final performance:

- CPU Maximum frequency (user configurable)
- CPU Boost mode (Turbo mode) (user configurable)
- Software application and the worst-case workload it creates for the CPU
- Peripherals being used (display, USB devices, number of active Ethernet ports)
- IPC mounting, orientation, clearances
- Ambient air temperature and how static the air is (airflow)

8.1 x86 Processor Thermal Design Features

8.1.1 Dynamic CPU Frequency and Boost Modes

Modern x86 architectures made a significant improvement in increasing computing performance while reducing power and heat dissipation at the same time. In a typical application, CPU activity varies and highly depends on memory, storage, and other I/O devices. When CPU needs data for the computation, it attempts to process it as quickly as possible and then, while waiting for the next set of data, goes to a low frequency, low power mode. Following this strategy, modern CPUs can transition to a very high CPU frequency (high power), but only for a limited time, and will then need to slow down and wait for more data. Such bursts of CPU activity come at a relatively high rate (milliseconds/microseconds). This strategy allows an increase in observable performance, while simultaneously averaging out to a lower heat dissipation. RXi2-BP and the AMD Ryzen processor that it uses supports these techniques, and they are enabled in UEFI settings by default. It is highly recommended to keep these settings enabled so that performance and thermal advantages of the architecture can be utilized.

8.1.2 CPU Throttling

One other important aspect of modern x86 architecture is the CPU's ability to protect itself from thermal events. This is called CPU throttling and results in the CPU reducing it's operating frequency when it reaches its maximum temperature. This throttling effect occurs automatically, and at the first glance might not be obvious to the user. Application performance, however, will be significantly reduced in this case and might lead to a variation in performance test results. To avoid performance loss due to CPU throttling, it is recommended to ensure that the CPU temperature is significantly lower than its maximum value in the worst-case ambient air environment. RXi2-BP is designed specifically to optimize heat transfer from the CPU die to the external heatsink, and in most cases will not be a factor in limiting Industrial PC performance.

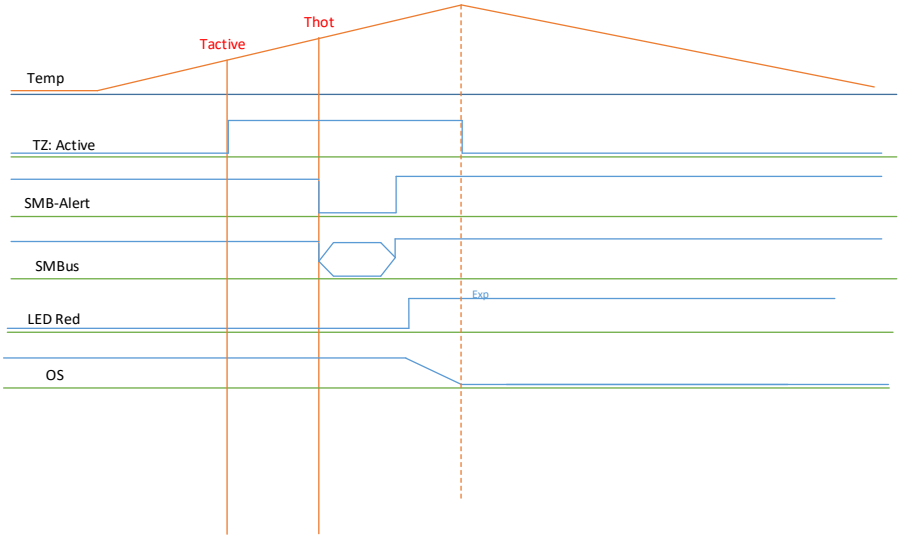
8.1.3 Temperature Monitoring and Protection

The RXi2-BP can monitor critical temperatures on-module and on-carrier and is configured to protect itself from an overtemperature condition.
IPC peripheral circuitry provides two static thermal zones (TZE1 and TZE2) and the CPU circuitry provides also two thermal zones (TZCP and TZD1).
The current thermal state can be always checked with the THRM LED? state.
If an overtemperature situation is present and the system shuts off, the last LED state is visible also in S4/S5.

The following activities are implemented when conducted in an ACPI aware Operating System. Any non-ACPI aware operating system must rely on internal hardware protection and must be evaluated separately on a case-by-case basis.

Once the T_{HOT} threshold is exceeded, the system will try to shutdown graceful into S4, depending on OS configuration.

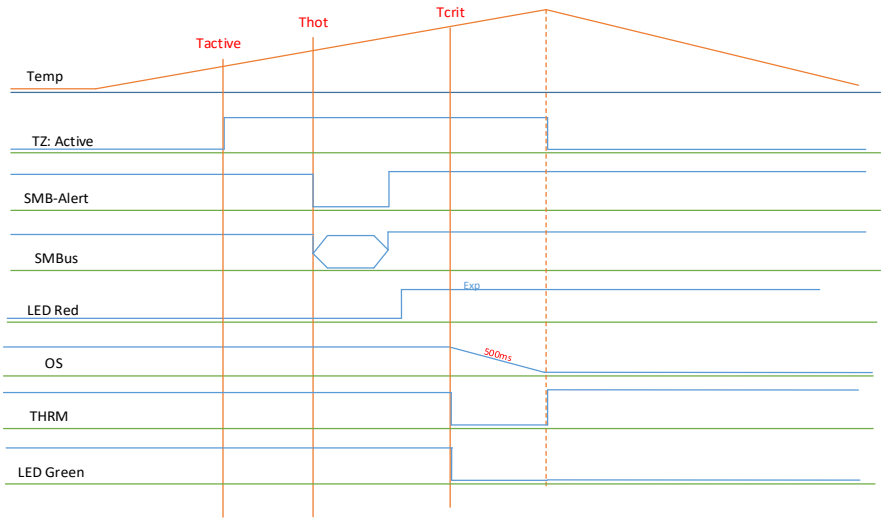
Figure 26: Thermal Zones: Tactive to Thot



Note: Thermal Zone ‘Active’ is optional and not implemented in fanless RXi2-BP design.

Once the T_{CRIT} threshold is exceeded, the system will try to shut down within 500ms into S5.

Figure 27: Thermal Zone Tactive to Thot to Tcrit



Note: Thermal Zone 'Active' is optional and not implemented in the RXi2-BP fanless design.

If the system is rebooting while the overtemperature situation is still present, the system will be shut down again after handing over to the operating system. However, this depends on how the operating system is configured. In case of questions, please contact Emerson support.
This could cause unbootable SSDs and other data loss, and therefore it is highly recommended to resolve overtemperature situations before rebooting the system.

8.2 Thermal Design Strategy

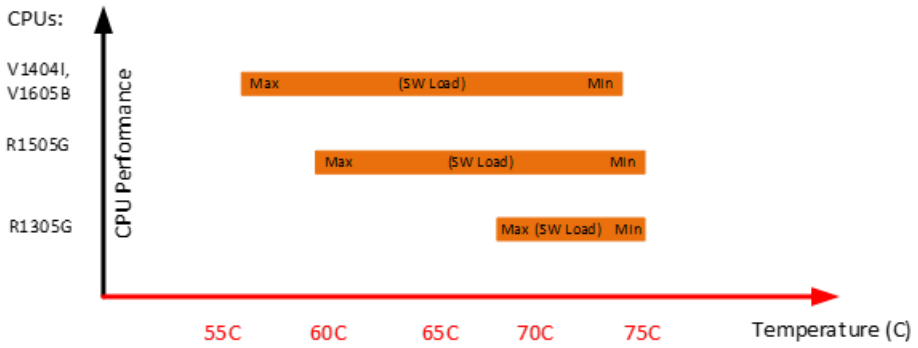
Having many parameters that influence the thermal performance of an IPC makes it difficult to perform thermal design by simply analyzing thermal test data and specifications.
The recommended way to assess thermal performance is to test the real software application, or a good approximation of it, in an environment that would be the worst-case for the real use scenario. This typically means static air, no airflow at all.
Note that typical thermal test chambers have a significant internal airflow, which results in higher thermal performance levels than those observed in real installations.

8.2.1 Thermal Guidance

The following is thermal guidance for the different RXi2-BP processor SKUs. It is based on zero airflows, and even a slight movement of air will dramatically increase the operating temperature range.

The graph below shows the maximum ambient temperature range, based on CPU SKU and application workload. Note that the lower temperature limit is not affected by application software load and purely depends on the product SKU as stated in the specification section.

Figure 28: Upper Ambient Air Temperature Limit Range



8.2.2 Thermal Test Data

Given the large number of factors influencing thermal performance, it is not feasible to test every possible permutation. Instead, the strategy is to provide test data for several specific test cases that allow the user to make first estimates and then perform real testing.
For a more detailed Thermal Test Report and further thermal design guidance please contact Emerson technical support.

Note: all testing is performed in still ambient air (zero airflows) with the unit mounted on the DIN rail with clearances as described in installation instructions within this manual.

Note: all tests ensure that CPU never throttles due to thermal limitations

Table 3: Power and Thermal Overview with Different CPUs and Workloads

CPU (note-1)	RAM	Display	Active Eth	Operating System	Application Workload (note-2)	CPU Util.	Average IPC Power	Maximum Ambient Air temperature
R1305G (2C, 4T, 10W)	4GB	XGA (text mode)	1	Linux Ubuntu 20.04	PACEdge Light workload	5%	8.5W	75 °C
R1305G (2C, 4T, 10W)	16GB	SXGA (graphics mode)	4	Win 10	Win Idle	5%	12W	75 °C
R1305G (2C, 4T, 10W)	4GB	XGA (text mode)	1	Linux Ubuntu 20.04	PACEdge Medium workload	38%	12W	75 °C
R1305G (2C, 4T, 10W)	4GB	XGA (text mode)	1	Linux Ubuntu 20.04	PACEdge Max workload	55%	14W	72C
R1305G (2C, 4T, 10W)	16GB	SXGA (graphics mode)	4	Win 10	Win Max Work Load	100%	19.5W	68 °C
R1505G (2C, 4T, 10W)	16GB	XGA (text mode)	1	Linux Ubuntu 20.04	PACEdge Light workload	5%	13W	75 °C

R1505G (2C, 4T, 10W)	16GB	XGA (text mode)	1	Linux Ubuntu 20.04	PACEdge Max workload	60%	27W	60 °C
V1605B (4C, 8T, 25W)	16GB	SXGA (graphics mode)	4	Linux	Win Idle	5%	11W	74 °C
V1605B (4C, 8T, 25W)	16GB	SXGA (graphics mode)	4	Linux	Win Max Work Load	100%	30.7W	56 °C

note-1: CPU column indicates AMD CPU model, number of Cores, number of Threads, and CPU maximum power setting, settable via UEFI.

note-2: Workload definition:

- Win Max Work Load: achieved by running a burn-in test application with the following settings: burn-in test, 70% CPU, 50% GPU in 3D rendering mode, 50% RAM, 50% COM, 50% USB, 50% SSD, 50% Ethernet. It represents maximum realistic application work and results in 100% CPU utilization, as reported by OS.
- PACEdge Light workload: PACEdge software, small application with Dashboard, InfluxDB database, Grafana, 5 sensors/sec
- PACEdge Medium workload: PACEdge software, small application with Dashboard, InfluxDB database, Grafana, 150 sensors/sec
- PACEdge Max workload: PACEdge software, small application with Dashboard, InfluxDB database, Grafana, 550 sensors/sec, maximum that can read.

Section 9: Specifications

This chapter provides specifications and other useful information about RXi2-BP.

The RXi2-BP must be connected from PowerIn port (Pin3, see Power-In for details) to FGND to ensure proper EMC protection.

9.1 Power Consumption

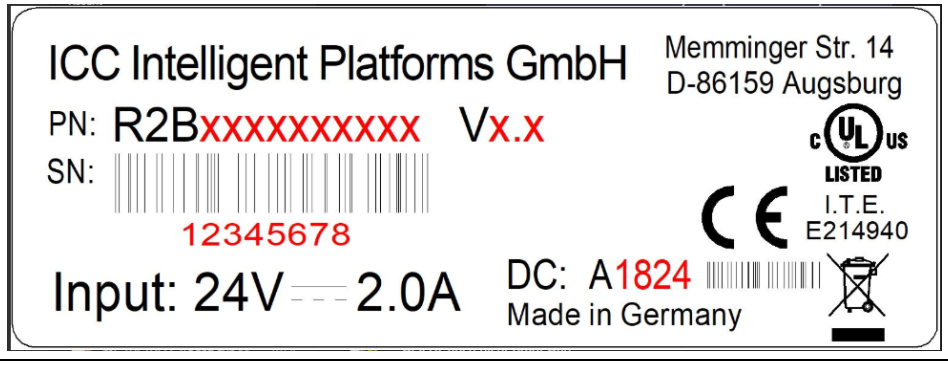
⚠ WARNING

The R2B industrial PC power supply must meet the requirements for SELV (safety extra-low voltage)/LPS (limited power source) or ES1/PS2.
L'alimentation du PC industriel R2B doit répondre aux exigences SELV (sécurité très basse tension) / LPS (source d'alimentation limitée) ou ES1 / PS2.

The max. current consumption can vary, depending on the CPU model, load, input voltage, and temperature, all tests running the same load:
V1605B, running a Burn-in at 25 °C (77 °F) with 90% load at CPU, 2D, 3D, RAM, Video, ETH, Serial, Disk

- 18V DC -> 1.77 A
- 24V DC -> 1.33 A
- 30V DC -> 1.07 A

Figure 29: UL Label



9.2 Temperature

Ambient temperatures and humidity values for the RXi2-BP IPC are provided in the following table. For more details on operating temperature and its dependency on application software, please refer to the Thermal Design section.

Temperature	
Storage	-40 to 85°C (-40 to 185 °F)
Operating (Standard SKUs)	0 up to 70°C (32 to 158 °F), at zero airflow
Operating (Extended SKUs)	-40 up to 70°C (-40 to 158 °F), at zero airflow
Humidity	
Storage	5 to 95% rH, non-condensing, at 40°C (104 °F)
Operating	

9.3 Shock and Vibration

Shock and vibration values for the RXi2-BP IPC are provided in the following tables for both mounting variants.

DIN Rail	
Impact, operating	IEC 60068-2-27: 1987 (test Ea) - 15g of 11ms half-sine pulse - 3 shocks each axis (=18)
Sinusoidal Vibration, operating:	IEC 60068-2-6: 2008 (test Fc) 5 to 13.2 Hz @ .079 inch displacement 13.2 -33.9 Hz @ 0.7g acceleration 33.9-57 Hz @ .012 inch displacement 57-500Hz @ 2G 1 Oct/min, 10 Cycles a 3 axes

Mounting Panel	
Impact, operating	IEC 60068-2-27: 1987 (test Ea) - 15g of 18ms half-sine pulse - 3 shocks each axis (=18)
Sinusoidal Vibration, operating:	IEC 60068-2-6: 2008 (test Fc) 5 to 13.2 Hz @ .079 inch displacement 13.2 -33.9 Hz @ 0.7g acceleration 33.9-57 Hz @ .012 inch displacement 57-500Hz @ 2G 1 Oct/min, 10 Cycles a 3 axes

9.4 Altitude

Altitude, air pressure, and ambient temperature influence the thermal operation of the components described in this document. They have been developed and tested at ~500 m (1650 ft) above sea level at a typical ambient temperature of 20°C (68 °F). Because of only marginal variations within a limited range of altitudes, this product operates as specified within altitudes from sea level to 1,000 m (6,560 ft), depending on the level.

The maximum altitude for the RXi2–BP IPC is specified in the following table.

Maximum Altitude	
Operating	2 km (6600ft)
Storage	12 km (40000ft)

9.5 Regulations and Certifications

Item	Specification
EMC	EMC Directive 2014/30/EU EN 61000-6-4 Emission standard for industrial environments EN 61000-6-2 Immunity standard for industrial environments FCC Part 15 B This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. CAN ICES-3 (A)/NMB-3(A)
Product Safety	LVD Directive 2014/35/EU IEC 62368-1 2nd Edition UL 62368-1 (UL file number E214940)

9.6 Battery

The RXi2-BP IPC contains a BR2032 lithium coin battery. The maximum current used by the mC10L19 module is 6µA. Depending on the operating hours and temperature, the estimated battery life is 2 to 10 years. Battery current is not used when the RXi2-BP IPC is supplied with 24V.

9.7 Technical Specifications

Item	Specification
Processor	AMD Ryzen V1000 and R1000 series
Memory	Up to 16 GB ECC 2400 MHz
SATA	M.2 M-keyed interface up to 6 Gb/s
Ethernet	4x Ethernet (10/100/1000 Mbit)
Graphics	1x DisplayPort
USB	2x USB 2 2x USB 3.2 Gen 1
Serial	1x RS232 1x RS4xx (galv. Isolated)
Non-volatile memory	MRAM, 1Mb
UEFI	UEFI AMI Aptio© 5

Section 10: Troubleshooting

10.1 Unexpected Restarts When Booting

AMD Ryzen processors have an increased range of power consumption, where for a very short period of time (milliseconds) they can consume significantly more power than the average power consumption. In the case that the unit is restarting when booting up the operating system, check the power supply, and make sure that it is rated well above maximum specified power consumption.

10.2 Booting Problems, Hardware Devices Not Present

When seeing unexpected hardware problems, missing hardware devices and interfaces, or booting issues, please start with restoring UEFI settings to factory default. To do that please reboot the unit, enter UEFI settings by pressing and holding the [F2] key right after power-up, and restoring default UEFI settings via applicable menus.

General Contact Information

Home link: http://www.emerson.com/industrial-automation-controls

Knowledge Base: https://www.emerson.com/industrial-automation-controls/support

Technical Support

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Any escalation request should be sent to mas.sfdcescalation@emerson.com

Note: If the product is purchased through an Authorized Channel Partner, please contact the seller directly for any support.

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